# PCT

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| (51) International Patent Classification 7 : | | (11) International Publication Number: | **WO 00/19679** |
|---|---|---|---|
| **H04L 29/00** | **A2** | (43) International Publication Date: | 6 April 2000 (06.04.00) |

(21) International Application Number: PCT/SE99/01650

(22) International Filing Date: 21 September 1999 (21.09.99)

(30) Priority Data:
09/164,243      30 September 1998 (30.09.98)      US

(71) Applicant: TELEFONAKTIEBOLAGET L M ERICSSON (publ) [SE/SE]; S–126 25 Stockholm (SE).

(72) Inventors: SCHMID, Glen; 90 Rue Upper Cambridge, Baie d'Urfe, Quebec H9X 2V6 (CA). LACHANCE, Matthieu; 716 de L'Epee #8, Outremont, Quebec H2V 3T9 (CA).

(74) Agent: ERICSSON RADIO SYSTEMS AB; Common Patent Department, S–164 80 Stockholm (SE).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published**
*Without international search report and to be republished upon receipt of that report.*

(54) Title: DATA LINK LAYER MANAGER FOR NETWORK ACCESS

(57) Abstract

A system, method, and apparatus are provided for selecting a data link layer (128) to connect a computer system (105) for data communication. An application (107) seeking data communication access over a data link layer (128) sends a request (step 309) to a data link layer manager (205). The data link layer manager (205) then determines the availability of a data link layer (128) from a plurality of data link layers (128) based on the user's preferences and selects (step 310) the most preferred data link layer (128) that is available.

# DATA LINK LAYER MANAGER FOR NETWORK ACCESS

## BACKGROUND OF THE INVENTION

5          Technical Field of the Invention

The present application is related to the process for accessing a network, and more particularly to a mechanism for selecting from amongst a plurality of possible data link layers in establishing network access.

Description of Related Art

10          One of the most popular uses of computers today is for the communication of information. Computers connected across a communication channel or medium are able to transfer large amounts of data electronically. The medium through which computers connects to each other for data communications is a connection across a physical layer established and maintained by a data link layer.

15          There are several communication media that are available to users. A very common communications medium used in the home environment is the public switched telephone network (PSTN). A user can connect his computer to a phone line via a modem, and then place a phone call to another computer similarly connected to the PSTN. A common communication medium in most business environments is a

20 Local Area Network (LAN) connection. In a LAN, the communicating computers are interconnected with a twisted pair of wires to form a network. Other communication media include a Wide Area Network connection (WAN), or a wireless (cellular) connection. Each communication medium offers a unique set of advantages and disadvantages making each communication medium more suitable for certain

25 computer data communication uses and less suitable for other computer data communication uses.

One of the fastest growing areas of computer data communications is the Internet. The Internet is a large number of computer networks from government agencies, the military, educational institutions, and businesses from all parts of the

30 world interconnected to form a network of networks. In order to use the Internet, a user must simply establish a communication channel between their computer and an Internet Access Device (IAD). Once a computer has access to the Internet, the user can have access to and exchange information ranging from stock quotes to the latest

scores in sporting events. Accordingly, the Internet has been referred to as the "Information Superhighway."

The Internet is also advantageous for use in establishing a data communication channel between two computers. While two computers could establish a
5   communication channel using one of the aforementioned examples of communication media, such a communication channel is expensive and sometimes impractical in cases where the communicating computers are separated by large geographic distances. Because the Internet is a global network, each computer can connect to an Internet Access Device (IAD) which is in closer geographical proximity. Accordingly, a
10  communication channel can be established between two computers using the Internet.

The computer systems connect to the IAD using a direct connection across a physical layer which is established and maintained by a data link layer. The physical layer provides the mechanical and electrical means for data transmission. The data link layer is built on the physical layer and is responsible for managing the
15  transmission of data over the physical connection. Those skilled in the art will recognize that many computer systems have a plurality of available communications media, and therefore, will have a plurality of physical layers and data link layers built on each physical layer.

Today, there are several applications that utilize data communications. The
20  File Transfer Protocol (FTP) allows computers to exchange, upload, and download files. TELNET enables a terminal to be connected to a remote host as if it were directly connected to the computer. Simple Mail Transport Protocol (SMTP) provides a method for exchanging electronic mail (E-mail). The Video Phone allows users at communicating computers to engage in a video conference. One of the most popular
25  applications is the Hypertext Transfer Protocol (HTTP) which is used by a browser, such as the Netscape Navigator™ or the Microsoft Internet Explorer™, to browse pages on the World Wide Web (WWW).

Depending in part, on the particular application, as well as the user habits, certain data link layers are most appropriate for certain application and less appropriate
30  for others. For example, applications like HTTP and FTP which involve the transfer of large amounts of data may be better suited for a data link layer built on a physical layer with a higher bandwidth. On the other hand, the SMTP might be better suited with data link layer built on a physical layer with a lower bandwidth which is usually more economical to use.

35  In the current system implementation, in order for the user to effectuate a preferred data link layer for an application, a user must designate a specific data link

layer from the computer's operating system before starting the application. In many
simple computer systems with only a single data link layer, designating the data link
layer in each application using the operating system is straight-forward. However, in
a higher-end computer system with access to several data link layers, assigning a
5    particular data link layer for each application is quite complex. Furthermore many
applications do not allow the user to designate their preferred data link layer in the
event many data link layers are available from the operating system. There would be
an advantage if the manner in which the user can designate preferences regarding the
data link layer for each application could be simplified and perhaps allow for the
10   selection by applications of alternate data link layer.


SUMMARY OF THE INVENTION

The present invention is directed to a system, method, and apparatus for
automatically selecting the data link layer an application utilizes in engaging in a data
communication. The user inputs a list of any number of data link layer preferences for
15   each application. When the application seeks to communicate, the presence and status
of each of the data link layers is examined, and the most preferred available data link
layer is selected for use by the application in engaging in the data communication.


BRIEF DESCRIPTION OF THE DRAWINGS

20   A more complete understanding of the method and apparatus of the present
invention may be acquired by reference to the following Detailed Description when
taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a block diagram of computer systems exchanging information;

FIGURE 2 is a block diagram of a software system embodying the principals
25   of the present invention;

FIGURE 3 is a flow chart of the operation of the data link layer manager in
accordance with the principals of the present invention; and

FIGURE 4 is an exemplary hardware environment configurable for embodying
the principals of the present invention.


30   DETAILED DESCRIPTION OF THE DRAWINGS

Reference is now made to FIGURE 1, wherein there is shown a block diagram
of computer systems 105a, 105b exchanging information over a communications
channel 110. The computer systems 105a, 105b run software, known as applications
107a, 107b, which exchange information during normal use. In order for computer

system 105a to exchange information with computer system 105b, a communications channel 110 must exist between the computer systems. The communications channel 110 can be, for example, a phone line in the public switched telephone network (PSTN), a local area network (LAN) connection, a wide area network (WAN) connection, an Internet connection, or even a cellular wireless channel (such as Cellular Digital Packet Data, or General Packet Radio Service). The Internet 115 has recently become a popular communications channel 110.

The Internet 115 is a network which joins together computer networks from educational institutions, the government, the military, and many private businesses in all parts of the world. Because the Internet includes computer networks all over the world, computer system 105a, and computer system 105b can connect to the Internet from an access computer 125a, 125b in close geographical proximity. The computer systems 105a, 105b connect to the access computer 125a, 125b using a direct connection across a physical layer 127a, 127b which is established and maintained by a data link layer 128a, 128b. The physical layer 127 provides the mechanical and electrical means for data transmission, and includes voltage specifications, current specifications, and impedence specifications. The data link layer 128 is built on the physical layer and is responsible for managing the transmission of data over the physical connection. Those skilled in the art will recognize that many computer systems have a plurality of available communications media, and therefore, will have a plurality of physical layers and data link layers built on each physical layer. Each data link layer 128a can establish a connection with a different access computer 125. The access computers 125a, 125b at which the computer systems 105a, 105b connect to the Internet 115 via the physical layers 127a, 127b are known in the art as Internet Access Devices (IAD) 125a, 125b. Although the IADs 125 are shown connected to a single computer system 105, it should be understood that IADs can connect to a plurality of different computer systems.

In addition to being connected to computer systems 105, an IAD 125a is physically interconnected with other IADs 125b, 125c, 125d using what is known as a mesh connection 126. The mesh connection 126 is established and maintained by a special data link layer 128c, such as Synchronous Optical Network (SONET), Synchronous Digital Hierarchy (SDH), Asynchronous Transfer Mode (ATM), or Frame Relay. When computer system 105a communicates to computer system 105b using the Internet, computer system 105a transfers data to IAD 125a. The IAD 125a passes the data to an Internet Protocol (IP) layer 135c residing on the IAD. The IP layer is used to route the packet to the right destination IAD. The IP layer 135c passes

the data to the data link layer 128c for transmission to IAD 125b. When IAD 125b receives the data, the data is passed to IP layer 135c which passes the data to data link layer 128c for transmission to computer system 105b.

Accordingly the communication channel 110 includes physical layers 127a, 127b and the Internet 115. Because the physical layers 127a, 127b connect the computer systems 105a, 105b to a point 125a, 125b that is in close geographical proximity, the physical connections are inexpensive and more practical to maintain. The use of the Internet 115 is also beneficial because the computer systems 105a, 105b can also exchange information with any other computer system on the Internet.

Once a communication channel 110 is established, the information to be transmitted must be formatted in a manner suitable for transmission. Additionally, information regarding the information transfer, such as the speed, ready to send signals, and ready to receive signals, must also be sent. The foregoing is straight-forward in cases where computer system 105a and computer system 105b are made by the same manufacturer. However a compatibility problem arises in cases where the computer system 105a and computer system 105b are made by different manufacturers.

Furthermore, a compatibility problem is certain to arise if the communication channel includes the Internet 115, because the Internet includes a vast variety of computer system made by many different manufacturers. Accordingly, a common communication standard is needed for transferring information. The most common communication standard used is known as the Transport Control Protocol/Internet Protocol (TCP/IP). Another common communication standard is the User Datagram Protocol (UDP).

TCP/IP includes a network layer 135, known as the Internet Protocol (IP), and a transport layer 140, known as the Transport Control Protocol (TCP). The IP layer 135 is a connectionless mode protocol designed to route messages between networks and includes the capability to segment and reassemble messages that must be routed between networks that support different packet sizes than the size supported by the different data link layers 128 on which the computers are attached. The TCP layer 140 provides end-to-end reliable transmission and includes advanced functions such as flow control, error control, and the exchange of status information. The TCP/IP addresses computers 105a, 105b connected to the Internet 115 using a 32-bit address known as an IP address. The IP address is often expressed as four decimal numbers ranging from 0 to 255 with each number separated by a dot (e.g., 127.100.32.255),

-6-

wherein each number is the decimal equivalent of a corresponding 8-bit portion of the 32-bit address.

The TCP/IP is usually implemented as a modularized program referred to as a TCP/IP stack 130. The application 107a, 107b involved in the information transfer interfaces with the TCP/IP stack 130 to transfer information. While the application 107 handles higher-level tasks related to the content of the information to be transferred, the TCP/IP stack 130 handles the details related to the transferring of the information and interfaces with the data link layer 128.

The application 107 can be, for example, the File Transfer Protocol (FTP), TELNET, Simple Mail Transport Protocol (SMTP), or Hypertext Transmission Protocol (HTTP). Depending in part, on the particular application 107, as well as the user habits, certain data link layers 128 are most appropriate for certain application and less appropriate for others. For example, for a remote user, applications like HTTP and FTP which involve the transfer of large amounts of data may be better suited for a data link layer 128 with higher bandwidth, such as an analog phone line. On the other hand, the SMTP application might be better suited with a wireless packet data connection.

Referring now to FIGURE 2, a block diagram of a software system 200 embodying the present invention is described. The computer system 105 includes a number of available physical layers 127 which can be used to connect to a responding computer 215. The responding computer 215 is a computer which is directly connected to computer system 105a via a physical layer 127, and can comprise, for example, computer system 105b or Internet Access Device 125a. Built on each physical layer is a data link layer 128. Operating and bounded to each data link layer 128 is a separate instance of a TCP/IP stack 130 or any other module for implementing a common communication standard 145 (communication module 145), such as a UDP module. Whenever a data link layer 128 bounded to a TCP/IP stack 130 is used to connect to the responding computer 215, an IP address or other means to identify the destination is obtained from the application 107.

A socket application program interface (API) implementation 201 with a well defined API 202 is inserted between the applications 107 and the TCP/IP stacks 130 and any other communication module 145 which are bounded to the data link layer 128. The socket API implementation 201 includes a data link layer manager 205 which controls the access of the applications 107 to the TCP/IP stacks 130 or communication module 145 which are bounded to the data link layers 128, when the

-7-

applications seek external data communication access to, for example, the Internet
115.

The user inputs into the data link layer manager 205 a series of preferred data
link layers 128 for each particular application 107. The user can also select any
5      number of alternate data link layers 128 to be used when the most preferred data link
layer is not available. Table 1 is an exemplary illustration of a user-defined preference
table of data link layers A-D 128 for each application. The user's preferences for each
application 107 can be stored in memory or on a disk in a manner well known in the
art and retrieved by the data link layer manager 205 when an application seeks to
10     access to a responding computer 215.

| Preferences<br>Applications | Most<br>Preferred | Second<br>Preferred | Third<br>Preferred | Fourth<br>Preferred |
|---|---|---|---|---|
| HTTP | A | B | C | D |
| SMTP | C | A | B | D |
| FTP | A | C | B | D |
| . . . | | | | |

**TABLE 1**

Those skilled in the art will recognize that designating the data link layer
preferences within the data link layer manager 205 one time is more convenient than
20     designating the data link layer manually in the Operating System at each time an
application is run. .Another advantage is that if the most preferred data link layer 128
is unavailable, an alternate data link layer can be designated.

When an application 107 seeks access to a responding computer 215, a request
is made by the application 107 to the socket API implementation 201 to open a socket.
25     A socket 220 is a service point that allows an application to use the underlying TCP
layer 140 and is described by a 16-bit port number. Whereas the IP address is used to
identify a TCP/IP stack 130 on a specific computer system 105, the port number is
used to identify a particular application 107 at the IP address. The request includes the
application type identified by the port number. The socket API implementation 201
30     then requests a specific instance of a TCP/IP stack 130 or communication module 145
bounded to a data link layer 128 from the data link layer manager 205. The data link
layer manager 205 responds by selecting a data link layer 128 according to an
algorithm (which will be described later) using both the user preferences as well as
information related to the status of each data link layer 128. The data link layer

-8-

manager 205 uses a Simple Network Management Protocol-Management Information Base II (SNMP-MIB II) 210 to poll the status of each data link layer 128. The SNMP-MIB II 210 is a Network Management Entity which contains parameters related to each data link layer 128.

5        When the data link layer manager 205 selects a data link layer bounded to a TCP/IP stack 130 for connection to the application 107, the data link layer manager 205 connects a socket 220 in the application to the TCP/IP stack bounded to the particular data link layer 128a. Accordingly, the application 107 can transfer information across the data link layer 128. When the application 107 no longer needs
10      access to the responding computer 215, the socket 220 is disconnected by the socket API implementation 201.

        Referring now to FIGURE 3, a flow chart illustrating the operation of the data link layer manager 205 selecting a data link layer 128 for an application 107 is illustrated. At step 305, an application 107 requests connection to the responding
15      computer 215. The data link layer manager 205 responds by determining the most preferred data link layer 128 and setting it as the current preferred data link layer (step 310). The data link layer manager 205 then determines whether the current preferred data link layer is connected (step 315). If the current preferred data link layer is in use, the data link layer manager 205 selects the current preferred data link layer and the
20      application 107 can transmit data using the current preferred data link layer 128.

        On the other hand, if the current preferred data link layer is not connected, the data link layer manager 205 scans the SNMP-MIB II interface table 210 for an interface equal to the current preferred data link layer. The data link layer manager 205 looks up the first interface from the SNMP-MIB II (step 322) and determines if
25      it is equal to the current preferred data link layer (step 325). If the first interface from the SNMP-MIB II is equal to the current preferred data link layer, the data link layer manager 205 sets up a connection to the responding computer 215 with the current preferred data link layer (step 330) and the application 107 can then transmit data (step 320). The data link layer manager 205 connects socket 220 to the TCP/IP stack 130
30      or communication module 145 bounded to the data link layer 128.

        If the first interface from the SNMP-MIB II is not equal to the current preferred data link layer at step 325, the data link layer manager 205 continuously looks up the next interface from the SNMP-MIB II (step 335) and compares it to the current preferred data link layer (step 325) until either an interface is found that is equal to the
35      current preferred data link layer (at step 325) or the entire SNMP-MIB II is scanned (at step 340).

If the interfaces on the entire SNMP-MIB II have been scanned, the data link layer manager 205 sets the current preferred data link layer equal to the next most preferred data link layer as designated by the user (step 345). If not all the data link layers 128 have been scanned (step 300), the data link layer manager 205 proceeds to repeat steps 315 - 345 until either an interface is found from the SNMP-MIB II which equals one of the designated preferred data link layers 128 or the entire list of designated preferred data link layers has been scanned (step 350). If an interface is found from the SNMP-MIB II which equals a designated preferred data link layer, the data link layer manager 205 sets up a connection on the data link layer 128 (step 330) and the application 107 proceeds to transmit data on the data link layer 128 (step 320). On the other hand, if the entire list of designated preferred data link layers has been scanned (at step 350), a data link layer 128 is not available for the application 107 and the connection to the responding computer 215 for the application 107 is denied at step 355.

Referring now to FIGURE 4, there is shown a representative hardware environment for a computer system 458 for practicing the present invention. A CPU 460 is interconnected via system bus 462 to random access memory (RAM) 464, read only memory (ROM) 466, an input/output (I/O) adapter 468, a user interface adapter 472, communications adapters 484, and a display adapter 486. The input/output (I/O) adapter 468 connects peripheral devices such as hard disc drives 440, floppy disc drives 441 for reading removable floppy discs 442, and optical disc drives 443 for reading removable optical disc 444 (such as a compact disc or a digital versatile disc) to the bus 462. The user interface adapter 472 connects devices such as a keyboard 474, a mouse 476 having a plurality of buttons 467, a speaker 478, a microphone 482, and/or other user interfaces devices such as a touch screen device (not shown) to the bus 462. The display adapter 486 connects a monitor 488 to the bus 462. The communications adapters 484 connect the computer system to a data processing network 492. The data processing network 492 may include any number of other computer systems, such as another computer system 458 or a server, as well as mass storage elements such as another hard disc drive 440, or another optical disc drive 443 for reading optical discs 444.

The data link layer manager 205 can be implemented as sets of instructions resident in the random access memory 464 of one or more computer systems 458 configured generally as described in FIGURE 4. Until required by the computer system 458, the set of instructions may be stored in another computer readable memory, for example in a hard disc drive 440, or in removable memory such as an

optical disc 444 for eventual use in an optical disc drive 443, or a floppy disc 442 for eventual use in a floppy disc drive 441.

Although the invention has been described with a certain degree of particularity, it should be recognized that elements thereof may be altered by persons skilled in the art without departing from the spirit and scope of the invention. Therefore, the invention is limited only by the following claims and their equivalents.

WHAT IS CLAIMED IS:

1.      A system for connecting a computer system to a responding computer,
wherein said computer system is running an application needing access to a data link
layer, and wherein said computer system is connectable to a plurality of data link
layers operable to connect said computer system to said responding computer, said
system comprising:

        a plurality of communication modules corresponding to said plurality
of data link layers, each of said plurality of communication modules for transmitting
data received from said application on a corresponding one of said plurality of data
link layers when said corresponding one of said plurality of data link layers connects
said computer system to the responding computer; and

        a data link layer manager for selecting for use by the application one
of said plurality of data link layers to connect said computer system to the responding
computer.

2.      The system of claim 1 wherein said plurality of data link layers
includes a data link layer selected from a group consisting of a land-based phone line,
a local area network connection, a wide area network connection, and a cellular
wireless interface.

3.      The system of claim 1, further comprising a Simple Network
Management Protocol-Management Information Base (SNMP-MIB) for storing
availability status of each of said plurality of data link layers.

4.      The system of claim 3, further comprising a memory for storing a list
for each application comprising a first preferred one of the plurality of data link layers
for use by the application, and a second preferred one of the plurality of data link
layers.

5.      The system of claim 4, wherein said data link layer manager is operable
to retrieve said list from said memory responsive to receiving a request from said
application to open a socket from said computer system to the responding computer.

6.      The system of claim 5, wherein said data link layer manager is further
operable to scan said SNMP-MIB to determine the status of said first data link layer,
select said first preferred data link layer to connect said computer system to the

responding computer wherein the status of said first preferred data link layer is available, and scan said SNMP-MIB to determine the status of said second preferred data link layer wherein the status of said first preferred data link layer is unavailable.

5          7.      The system of claim 1, wherein said data link layer manager is operable to connect a socket associated with said application to one of said plurality of communication modules, responsive to selecting one of said plurality of data link layers to connect said computer system to the responding computer.

           8.      The system of claim 1, wherein said communications modules
10   comprise a Transport Control Protocol layer and an Internet Protocol layer.

           9.      In a computer system connectable to a plurality of data link layers, wherein said computer system runs an application, a method of connecting said computer system to a data link layer, and wherein said computer system comprises a plurality of communication modules corresponding to said plurality of data link layers,
15   said method comprising the steps of:
           receiving a request to open a socket from an application of said computer system to a data link layer;
           retrieving a list comprising a first preferred one and a second preferred one of said plurality of data link layers;
20          polling the availability status of said first preferred data link layer;
           transmitting data from said application across said first preferred data link layer if said first preferred data link layer has an available status; and
           polling the status of said second preferred data link layer, wherein the status of said first preferred data link layer has a not available status.

25          10.     The method of claim 9, wherein said step of polling the status of said first data link layer further comprises the step of scanning a Simple Network Management Protocol-Management Information Base (SNMP-MIB).

           11.     The method of claim 9, further comprising the step of connecting a socket associated with said application to one of said plurality of communication
30   modules.

12.    The method of claim 9, wherein said communication modules comprise a Transport Control Protocol layer and an Internet Protocol layer.

13.    An article of manufacture comprising a computer usable medium having computer readable program code means embodied thereon for connecting a computer system running an application to a data link layer, wherein said computer system is connectable to a plurality of data link layers, and wherein said computer system comprises a plurality of stacks corresponding to said plurality of data link layers, the computer readable code means in said article of manufacture comprising means for:

receiving a request to open a socket from an application of said computer system to a data link layer;

retrieving, from a memory, a list comprising a first preferred data link layer, wherein said first preferred data link layer corresponds to a first data link layer of said plurality of data link layers, and a second preferred data link layer, wherein said second preferred data link layer corresponds to a second data link layer of said plurality of data link layers;

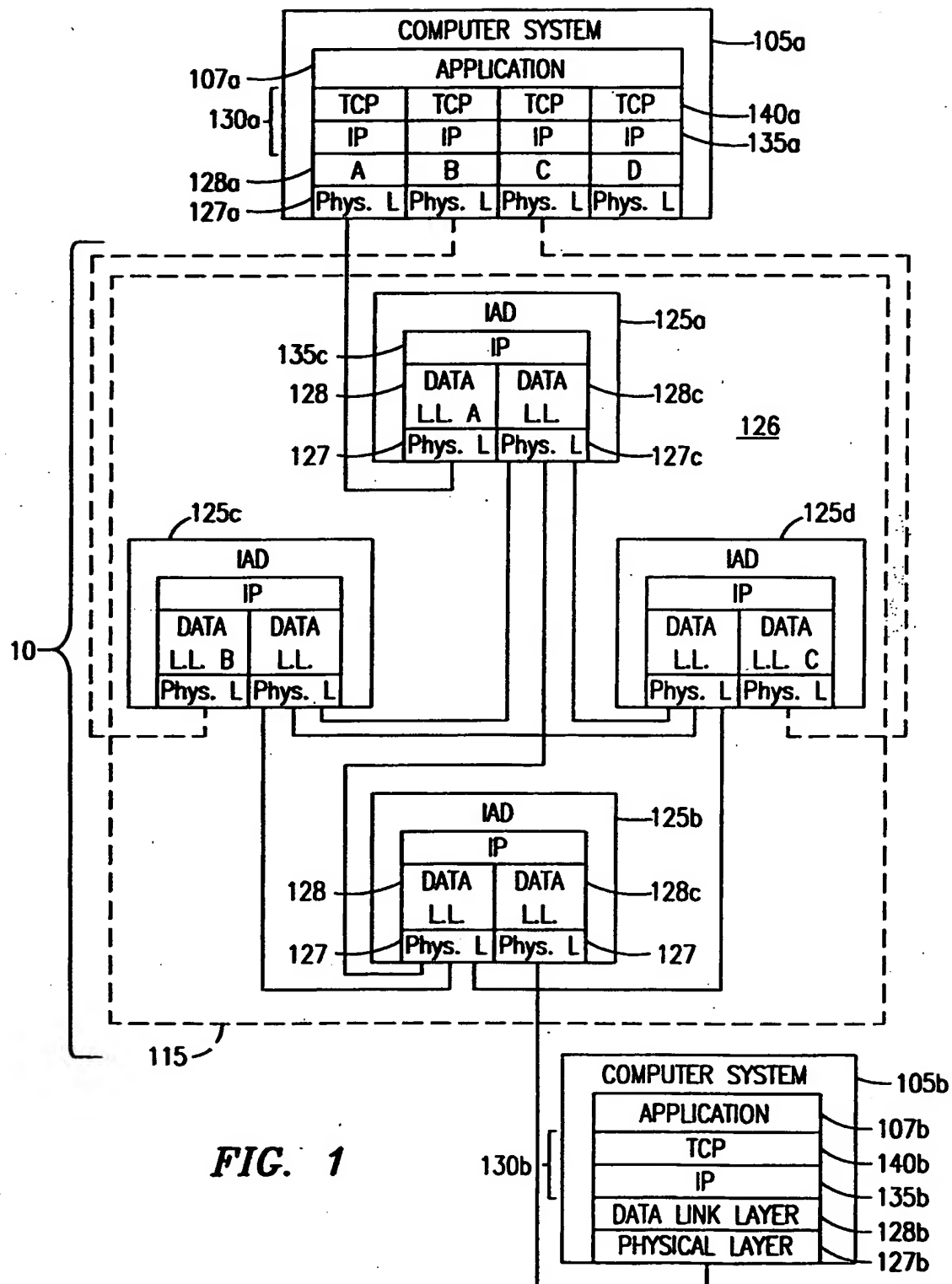polling the availability status of said first data link layer;

transmitting data from said application across said first data link layer, wherein the status of said first data link layer is available during said polling step; and
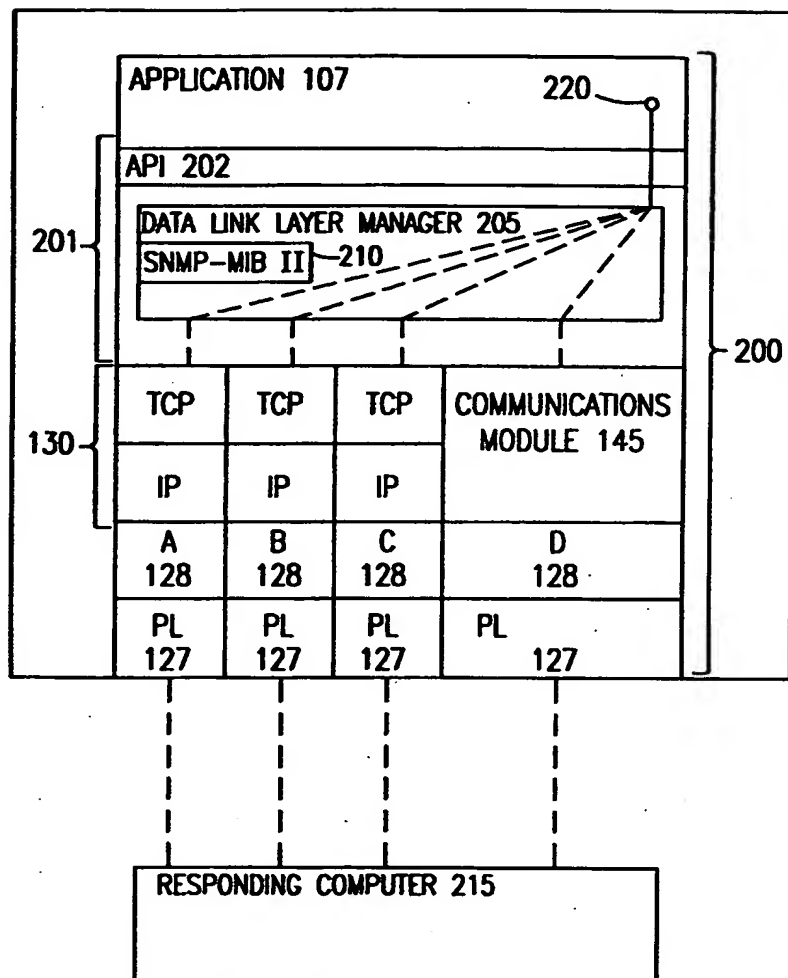
polling the status of said second data link layer, wherein the status of said first data link layer has a not available status.

14.    The article of manufacture of claim 13, wherein said means for polling the status of said first data link layer further comprises means for scanning a Simple Network Management Protocol-Management Information Base (SNMP-MIB).

15.    The article of manufacture of claim 13, wherein said computer readable code means further comprises means for connecting a socket associated with said application to one of said plurality of stacks.
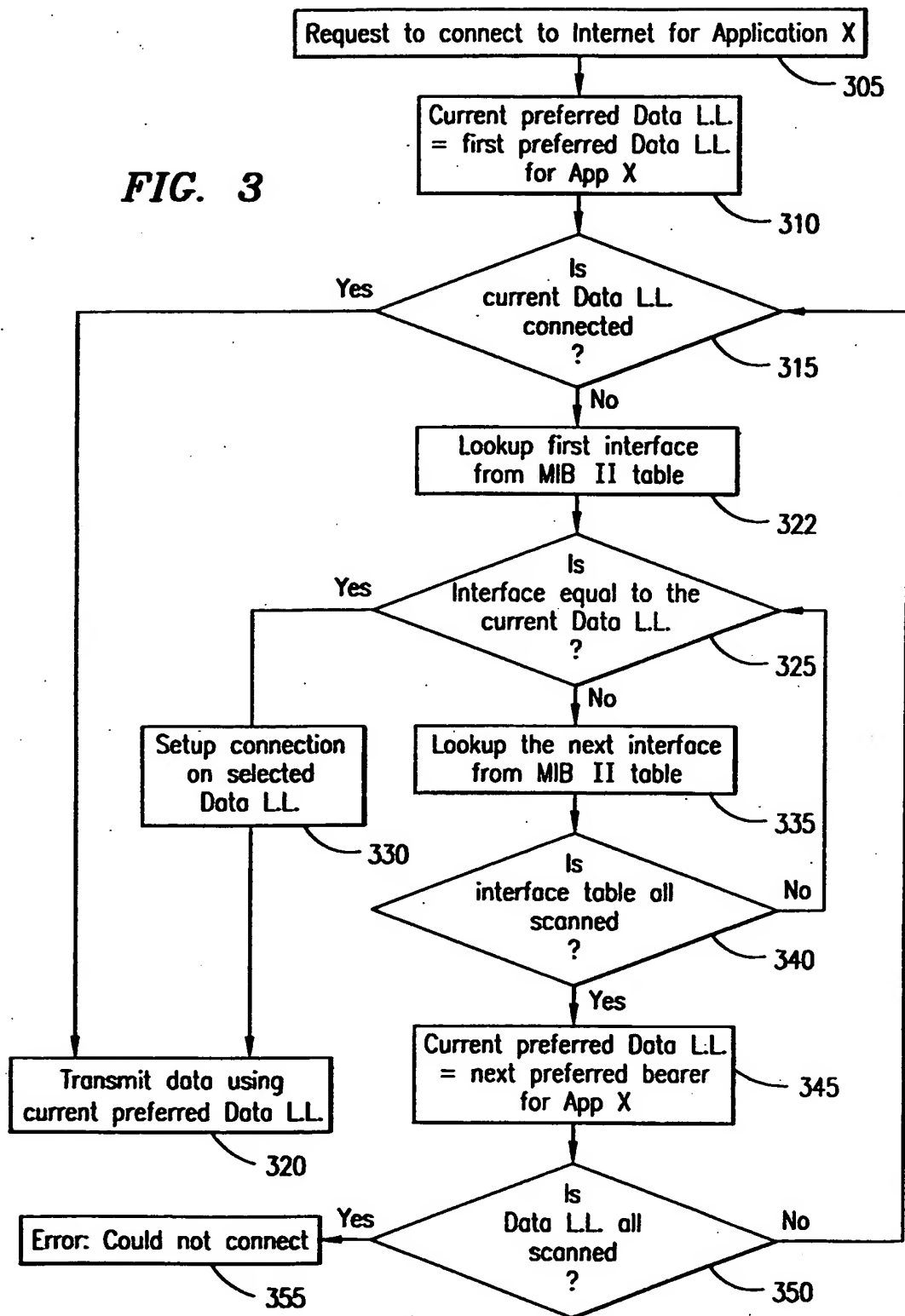
16.    The article of manufacture of claim 13, wherein said communication modules comprise a Transport Control Protocol layer and an Internet Protocol layer.
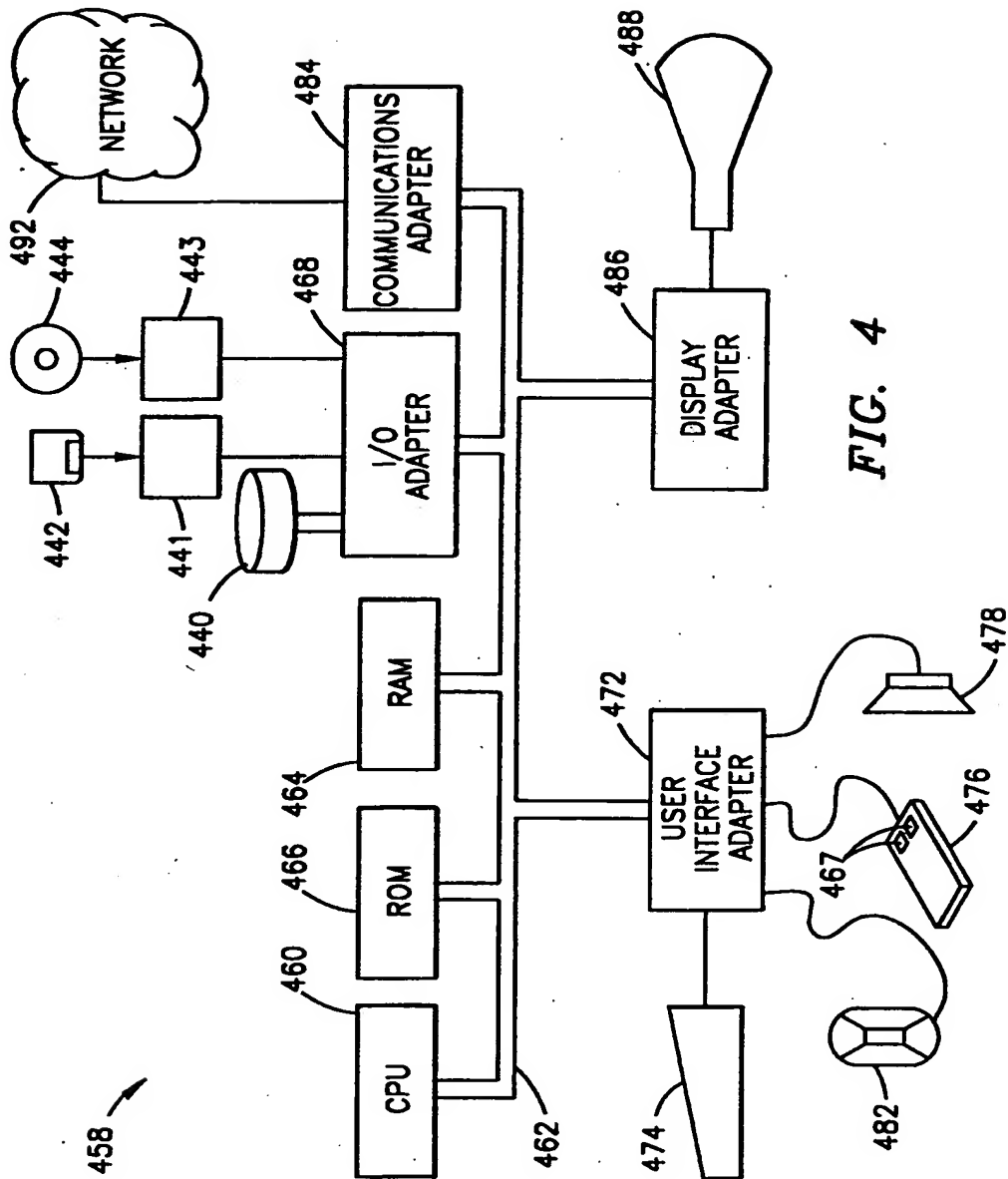
FIG. 1

FIG. 2

**FIG. 3**

Request to connect to Internet for Application X ⟍ 305

Current preferred Data L.L.
= first preferred Data L.L.
for App X ⟍ 310

Is
current Data L.L.
connected
? ⟍ 315

— Yes →

— No →

Lookup first interface
from MIB II table ⟍ 322

Is
Interface equal to the
current Data L.L.
? ⟍ 325

— Yes →

— No →

Setup connection
on selected
Data L.L. ⟍ 330

Lookup the next interface
from MIB II table ⟍ 335

Is
interface table all
scanned
? ⟍ 340       — No →

— Yes →

Current preferred Data L.L.
= next preferred bearer
for App X ⟍ 345

Transmit data using
current preferred Data L.L. ⟍ 320

Error: Could not connect ⟍ 355    — Yes —

Is
Data L.L. all
scanned
? ⟍ 350       — No →

FIG. 4